

A close-up of a woman's face, looking slightly to the right. Her face is partially obscured by a bright, orange and yellow nebula-like glow. The background is a deep blue space filled with numerous white stars of varying sizes. A faint, light gray grid is overlaid on the entire image.

Adrift in Space and Time and The Games of Entropy

The first two of the Seven Secular Sermons

Sermon One: Adrift in Space and Time

Now this is going to be fun!
It truly does feel great
to realize we all are one.
So we shall meditate.

This meditation's rhyming verse
describes a paradigm
of us inside this universe,
adrift in space and time.

It's nice that we can simply start
by recognizing how
a check of every body part
can help us be here now.

We feel our bellies and our heads
and just become aware
how arms and hands and feet and legs
are feeling everywhere.

Between and through them circulate
our blood-streams to refresh
the oxygen that activates
awareness in our flesh.

And as we slowly breathe we find
that doing so can draw
us into a more present mind
to feel the moment raw.

With every breath we take and leave,
we clear our inner eyes
and fully, lucidly perceive
each second passing by.

Our mindful meditative selves
grow out of living meat
and help our bodies stay in health
by finding what we need.

So let's do that now. Let's explore
and see what's to be found.
Outside our bodies, there is more.
Let's take a look around!

Unless we're blind we're free to see,
unless we're deaf, to hear
and realize we're utterly
surrounded by what's here.

This place surrounding us here now
where we consider this,
is just as present, anyhow,
as our breathing is.

Our breaths connect within the air,
within the atmosphere.
The envelope of sky we share
is also part of here.

We also share what rests beneath:
Our bodies' place of birth
from which came all who now here breathe
as children of the Earth.

Of course there's more than senses show
around us near and far.
The sky above, the Earth below;
there's more to where we are.

To North and South, to West and East,
the world goes on and on,
the planet every plant and beast
and we now breathe upon.

Of all the Earth, we barely know
the surface we begrime,
upon the spinning rock below,
adrift in space and time.

Our calm and meditating minds
can feel this easily.
Imagination goes behind
all things our eyes can see.

To find, as further out we go,
whichever way we face,
to left, to right, above, below,
the solar system. Space.

It's blacker than the night of course
and bigger than the sky
and it is hard to see because
it was not made for eyes.

It effortlessly overwhelms
imagination. Still
and everywhere around this realm
extends and always will.

Around us all and everyone
we've met or ever can,
extends the system of the Sun
that dwarfs all realms of man.

Out there, all human joy and strife
and knowledge matter not.
Out there, this fragile ball of life
is just a pale blue dot.

And there are other, bigger dots
and countless asteroids.
This Earth is one among a lot
around us in the void.

Yet all of them combined appear
like specks of dust compared
to one enormous blazing sphere,
the center that they share.

A thousand times as ponderous
as all that circles it,
it radiates splendiferous
and indiscriminate.

It weighs three-hundred-thirty-three
times thousand times as much
as Earth, which seems like mere debris,
a tiny circling smudge.

There's hydrogen inside the Sun
that lets it shine so bright
by burning up: Four million tons
per second fuse to light.

This fusion forges helium
and other specks of dust
that constitute the medium
from which grows life like us.

But near the Sun, its gamma rays
and heat do not allow
life smart enough to be amazed
at what is true here now.

And further out, it stays too cold
for molecules to toy
with games of entropy that mold
the life that we enjoy.

While outermost, in blackest night,
drift frozen rocks so far,
to them our splendid sphere of light
looks like another star.

We're lucky Earth is temperate
or life could not have spawned.
This planet would stay desolate
and all of us unborn.

As fully as we do depend
on Earth that we live on,
we also clearly understand
we're children of the Sun.

And yet the Sun, though all must spin
around it, merely is
a rare domain of light within
a yawning black abyss.

In outer space surrounding us
lie distances too great
for us to easily discuss
or even contemplate.

For space is mostly nothingness
around us everywhere,
the freezing dark is limitless
in empty space out there.

Of course there is some gravity
that massive things impart
and maybe some dark energy
that pushes them apart.

But nothing's there to hear or see
or smell or taste or touch
and trying to imagine, we
can think of nothing much.

And still we feel, for what that's worth,
beyond the seen and near
the vastness outside planet Earth
that's real now and here.

In meditation, we somehow
expand our minds to try

to feel the system we are now
and here surrounded by.

The moons and planets we can see,
as far as we have found,
are lifeless. Earth now seems to be
the only game in town.

Yet all these places we could go
and cultivate and fill,
are merely specks in what we know
remains much bigger still.

The stars, these many tiny lights,
each are a blazing sun
and circling them, caught in their might,
are planets being spun.

Yet humans cannot see that far.
The pixels of our eyes
are just too few, which is why stars
look like they're equal-sized.

Through telescopes, we understood.
The stars all shine so bright
that only monstrous distance could
dilute them into night.

These distances define the space
that all stars occupy
and make a single, real place
that we're surrounded by.

The stars that shine all night and day
within or out of sight
are what our home, the Milky Way,
appears like from inside.

Our Milky Way contains at least
one hundred billion suns.
Through gravity, they all are pieced
together into one.

Around this place, where we now feel
what we are breathing in,
these suns form one tremendous wheel
with one tremendous spin.

And all these suns are shining clear,
enormous and sublime.
They all are real here where we're
adrift in space and time.

Unmoved by beings such as we
on Earth, our small enclave,
the stars around us now will be
the stars around our graves.

Except for those which have gone through
their hydrogen supply
and end as all things someday do,
for even stars must die.

And some, much bigger than our Sun,
burn brighter still and must
explode one day, when they are done
with making light and dust.

These supernovas, as we call
them, burst stupendously.
Some can outshine the sum of all
stars in the galaxy.

With their magnetic fields unfurled,
their yields annihilate
or sterilize abundant worlds
that life might populate.

Yet all we breathe and eat and drink
comes from these massive bombs.
We're supernova-dust that thinks
about where it came from.

And since the stars have made the clay
that led to our birth,
we're children of the Milky Way,
as are the Sun and Earth.

But supernovas are quite rare.
Three times per century
does one of them explode somewhere
within our galaxy.

Yet many supernovas do
each second detonate
in all the galaxies whereto
we now shall escalate!

A million times much further out
than all the Milky Way,
more galaxies are shining proud
around us here today.

These galaxies, each huge and wide,
much like the one we're in,
outnumber all the stars inside
our home and origin.

Around where we consider this,
whichever way we face,
drift billions of these galaxies
right now, right here, in space.

We realize with utter awe
and know beyond all doubt:
Beyond this world are trillions more
that we could learn about.

And almost all of them must be
absurdly far away
in ultimate reality
beyond the Milky Way.

From here where our bodies stay,
imagination climbs
through further outer Milky Ways
adrift in space and time.

And through the emptiness between
in almost all of space,
where not a single star is seen
in almost every place.

And meditation does allow
our minds to feel it all.

To feel the Universe that now
surrounds us as a whole.

Despite all suns that intersperse
this dark continuum,
most places in this Universe
are total vacuum.

And therefore, atoms are quite rare.
Yet trillions of them have
condensed into the flesh we wear
that draws this very breath.

Two thirds of atoms in us are
still hydrogen which sprang
into existence not in stars
but back in the Big Bang.

For all the time since time began,
as entropy made space,
each travelled an enormous span
to meet here face to face.

Through vacuum and solar flame,
they found their way somehow.
And we as that which they became,
thus came to meet here now.

Through all we breathe and drink and eat,
they travel and endow
with nutrients the living meat
in which we meet here now.

The atoms that we are traverse
all space and time, which means
we're children of the Universe
and we have always been.

The atoms in us met before
and they will meet again,
compelled by universal law
out in the there and then.

One endless cosmic maelstrom,
age-old and ever new,
is where we all are coming from
and where we're going to.

The knowledge we are made of dust
compels us to admit
the Universe is in us just
as we are within it.

From here we may arise to see
and claim as our own
the secrets of reality
just waiting to be known.

And so we know the infinite
is absolutely real.
It's here, it's now, it's intimate,
this vastness that we feel.

Whatever else is true for us,
we'll always know this rhyme.
We'll always know we're made of dust
adrift in space and time.

Sermon Two: The Games of Entropy

So, being dust, what lets us live?
What raises us above
the countless, mindless, primitive,
raw atoms we're made of?

There is no life within this dust:
Most specks remain unchanged
from back in ancient stars. It must
be how they are arranged.

Each human we have ever seen,
each beast, each bird, each tree:
We all are atoms that have been
arranged amazingly.

All these arrangements big and small
might well inspire mirth
in us surrounded by them all,
the greatest show on Earth.

There's more to learn in nature than
is found in any book
and it appears more alien
the closer that we look.

Below the surfaces we see,
the skin and scales and bark,
the cycles of biology
are working in the dark.

Right now our lungs take oxygen
out of the air we share,
our hearts and bloodstreams take it then
and pump it everywhere.

If we zoom closer we can see
our lungs to be a place
where in a dance of chemistry
our breath and blood embrace.

We're built from many works of art,
from organs that combine
small tissues, each a special part
with intricate design.

Now each such tissue then contains
innumerable cells
and here, inside each cell again,
are tiny organelles.

Within all forms of life we see
there's hidden vastly more
bewildering complexity
that must inspire awe.

The stars we see through telescopes
are big and bright and far,
but we find life, through microscopes,
yet more spectacular.

In fact, there's more complexity
in one small butterfly
than we see in the galaxy
out there beyond the sky.

All living things we've ever seen
are built from living cells;
each cell is like a small machine
comprised of chemicals.

In all our cells, there's utterly
infinitesimal
molecular machinery.
They're nanotechnical.

Still zooming closer, we just find
a multiplicity
of ancient atoms that are kind
of bouncing randomly.

The static things we think we know
are maps. The territory
has constant and chaotic flow
beneath the shapes we see.

It's here right now, as close to us
as anything can be.
The movements of the specks of dust
shape our reality.

The randomness in what they do
we call their entropy
and its domain is whereinto
our lives have come to be.

It disassembles ordered things
unless they can outgrow
its ceaseless, blind disordering
and spread within its flow.

It moves the dust and lets it start
to join the game or dance
of molecules that fall apart
or last a while, by chance.

So hydrogen and oxygen
join water which can gain
entropic warmth that makes it then
play games of cloud and rain.

Where entropy is less intense,
these drops will crystallize
and dance the longer, slower dance
of snowflakes and of ice.

Inside ourselves we feel right now
our living, breathing form
to be and to remain somehow
comparatively warm.

Our atoms lost the stellar heat
and left behind the cold
of empty space. In warmth we meet,
in warmth does life unfold.

For heat destroys all forms and flows
that chance may introduce,
while cold does not select for those
that work and reproduce.

In warmth the growing randomness
of entropy can be
just right for the profound finesse
of biochemistry.

Warmth such as ours makes atoms stay
a little restless so
they bump into each other's way,
react and change and grow.

With carbon in particular,
reactions are not rare,
but the majority by far
do not lead anywhere.

Yet chemical reactions need
mere moments to be done
and let the dust join games that lead
to others further on.

So given lots of time, mere chance
must sometimes foreordain
that specks of dust will start to dance
along reaction chains.

Around 4 billion years ago,
on Earth, a warm wet sphere,
reaction chains began to grow
the paths that led us here.

In chains of random chemistry,
the molecules that they
unite can in their unity
join bigger games to play.

In some, the flow of molecules
could circle and arrive
in lasting cycles that grew tools
to multiply and thrive.

In them, the games that entropy
forever plays have come
to let emerge biology
that all of us grew from.

We're built from this, from cyclical
and still ongoing games
of atoms and of chemicals
that do not know our names.

These games take place in everything.
In every breath we take
are trillions of them happening.
All cells in us partake.

A cell is what we call games far
too numerous to count
sustaining one shared reservoir
that holds their whole amount.

Here games that build each other spin
a membrane to engulf
them all. A greater game begins:
A game that builds itself.

Though molecules can't learn or feel,
the cells they joined into

have learned to sense and eat and heal
as in us now they do.

The games inside them match and fit
each other. They create
each other's necessary bits
and thus self-replicate.

The largest, DNA, has space
like memory to hold
stored information – that's a place
for new games to unfold.

From codes that cells store in there stem
large hosts of proteins
that build us here to carry them.
We call these codes our genes.

Cells need to harvest energy
to fight their slow decay
by ever-present entropy
and thus keep death at bay.

Some games can help the cells with this.
Hence some cells now include
microbial photosynthesis
that harvests light as food.

Cells work so well that everywhere
we look now, they are found:
On every surface, in the air
and deep within the ground.

They are the winners that remain;
the losers are all dead.
Life born to entropy's domain
must die if it can't spread.

These cells, competing, growing rife
for countless years on end,
turned Earth into this ball of life
to which we now attend.

Once single cells were all there was,
but some of them became
much bigger forms of life because
they joined still greater games.

In unity they found new ways
to gain more energy
and grow within the fertile space
we humans call the sea.

With size, forestalling entropy
becomes much more complex
but life invented, brilliantly,
a game that does it: sex.

Sex tests and recombines the genes
that parents contribute,
makes novel progeny and screens
resulting attributes.

And genes that happen to succeed
in making progeny
will travel in them and proceed
through time and entropy.

In each of us now breathing here
are genes that long have gone
through many generations – we're
built just to pass them on.

And entropy remains at play.
All life that it has bred,
however complex, must obey
its rule that things must spread.

To do this, cells must organize
and function as a whole,
so they have nerves which harmonize
their work on common goals.

One common goal is to explore
new places which is why
some sea-born creatures left for more,
for land and for the sky.

And thus arose the multitude
of Earth's whole biosphere
that fills us with this gratitude
we feel for living here.

Yet now the human species shapes
this world – and that transpires
because a recent bunch of apes
played cooking food on fires.

This gave them much more energy
and they could use these gains
to breed descendants such as we
with big and playful brains.

With playful brains, we understand
the games of entropy
that played us into being and
can play them consciously.

With growing knowledge we can trace
all aspects of our lives
to games that built the mental space
wherein this knowledge thrives.

At every scale we see again
so many things that draw
upon each other. We might then
think that's design or law.

And yet, no law or plan exists.
Mere chaos has let on
each scale some lucky games persist
that others built upon.

Now we join into greater games
that may outlast us all,
including laws and wealth and claims
of states that rise and fall.

Great games like science or the arts
or cities or machines
we hope will help their human parts
like bodies help their genes.

And in a sense, we all are one
gigantic global game

of interplaying games begun
without a plan or aim.

That's true and yet one brain can't grasp
it all: It's too immense.
One can but try and fail and gasp
at life's magnificence.

So human brains invented speech
and writing to transport
what brains would want to share and teach
each other: useful thoughts.

By sharing thoughts, we operate
like large connected minds
that ponder and accumulate
the knowledge that we find.

The thoughts we share help harmonize
our work on common goals
and join in ways to organize
the knowledge we control.

This knowledge helps us build new games
that let us dive and fly
and even let us ride on flames
to pierce the waiting sky.

We humans know there's so much more
surrounding Earth: the stars!
We're curious and can't ignore
how unexplored they are.

The games of entropy coerce
us still. We must diffuse
to roam this playground universe
and put it all to use.

One day, self-replicating ships
will from this Earth be hurled
to leave on interstellar trips
and spread from world to world.

In but a short few million years
such ships can easily
spread many daughter biospheres
throughout the galaxy.

And yet, no other life comes here.
The sky we watch looks still.
No life is spreading – maybe we're
the only life that will.

But probably, out there we'll meet
life stranger than our own,
life made of something else than meat
by games as yet unknown.

And all we'll find and understand
can join in what will be
still greater, cosmic, truly grand
new games of entropy.

One day, all worlds our ships can reach
shall learn to live and care,
for we have many games to teach
to all the dust out there.

About this project

My name is Daniel Böttger. I'm a young scientist who lives in Leipzig, Germany.

I began the Seven Secular Sermons project in 2012, in an attempt to share the intense gratitude I feel towards this marvelous universe we are happening in. The sermons are (to be) a series of seven guided meditations on aspects of the universe. In verse and rhyme, they invite us into inner journeys towards a more profoundly satisfying appreciation of reality at large.

Due to the complexities of summarizing numerous complex ideas into meditative poetry, and the restrictions of their form, these meditations are being written very slowly. The first two took 18 months each, and it seems sensible to assume the following ones will take about the same amount of time each. If you would like to be notified about new sermons, you can follow @7SecularSermons on Twitter or subscribe to the Seven Secular Sermons YouTube channel.

Each sermon gives a poetic introduction to a field of knowledge that has something to say about what we are, in the following order.

1. **Adrift in Space and Time** – Astrophysics
2. **The Games of Entropy** – Molecular Biology
3. **One of Us** (*working title*) – Evolutionary Biology
4. (*no title yet*) – Physiology
5. (*no title yet*) – Memetics
6. (*no title yet*) – Brain Sciences
7. **United in the Quest for Truth** (*working title*) – Philosophy

They are connected in an arrangement loosely inspired by the Open Systems Interaction model of communication systems:

1. Physical layer – The physical atoms that everything runs on.
2. Data link layer – The self-replicating patterns of links between atoms.
3. Network layer – The network of relations between all life on Earth.
4. Transport layer – The circulations that power animals such as us.
5. Session layer – The dialogues between individuals that give rise to culture.
6. Presentation layer – The mental representations that give rise to the mind.
7. Application layer – The relationship of reason and reality.

Each follows logically from the previous one and each of them has to be present in order for the whole to come together as it does.



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